Content, Modals and Attitude Predicates[*]

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1   Introduction: Why Truthmaker Semantics?

The formal semantic tradition in linguistics has been dominated by a very specific toolbox, and set of choices for being explicit about truth conditions. If we grant that the job of semantics is to explain how language works to create systematic and exploitable relationships between the symbols deployed and a commonly apprisable external reality, we need to have a method in place for describing the relation between language and that external reality. We can call this 'truthmaking':

> "The idea of truthmaking is the idea of something on the side of the world - a fact, perhaps, or a state of affairs - verifying, or making true, something on the side of language or thought - a statement, perhaps, or a proposition." Fine (2014).

We can think of truthmaking as the anchoring idea that makes possible modern semantic theory. However, it is often implicitly assumed by the field that once the idea of truthmaking as an anchoring assumption is embraced as a starting point, then the choice of a particular formal language for implementing that idea is a convenience, and that there are no meaningful discussions to be had at this level. However, depending on one's desiderata for a semantic theory, choice of framework, its axioms and ontology, is highly relevant and makes a big difference to the ways in which formal analyses interact with syntactic theory on the one hand and cognitive science on the other.

Truthmaker semantics (Fine 2014, Fine 2017b, Fine 2017c) and Moltmann's work more generally is an example of a consistent body of work which

systematically critiques the status quo and offers alternatives in the form of different kinds of truthmaking formalizations, ones which do not require the device of possible worlds. The status quo is so ubiquitous that it is rarely deconstructed (but see Pietroski 2018), and the standard toolbox is often presented as logical or conceptual necessity, not a framework that is chosen from among others (at least not by the younger generation of trainees and foot soldiers). Apart from the particular philosophical and semantic insights she brings to her subject matter, the reason why her work is so important is the fact that she is actively engaged in alternative theory construction, with a different set of criteria for explanatory adequacy. However, engagement and commentary are vital to the enterprise as well since progress is not made unless those in the larger intellectual milieu are exposed to the arguments and have the relevant kinds of conversations with each other. In this short commentary article, I propose to do just that: (i) summarize and evaluate the truthmaker semantics enterprise as a whole from my own perspective (ii) summarize and evaluate Moltmann´s. particular proposal concerning modal objects, which proposes an extension and elaboration of truthmaker semantics and finally (iii) sketch how my own research agenda suggests a rather different kind of elaboration of the truthmaker semantics enterprise and contrast it with the direction Moltmann takes for attitude predicates. In the end, the aim is not to pass final judgement on specifics, but to show how the change in thinking that comes with truthmaker semantics opens up a productive and stimulating space for evaluating classic semantic puzzles and of the relationship between syntax and semantics.

The status quo involves associating the content of a declarative utterance with the set of possible worlds in which it is true, a tradition which begins with Montague (1974) where the set of possible worlds is the fully expanded set of possible ways the world could be (Lewis 1973, Lewis 1986). One well-known alternative is to associate the content of a declarative sentence instead with the situations in which it is true (Barwise and Perry 1983, Kratzer 2014). In this view, situations can be as large as worlds but also potentially smaller and more specific. There are semantic applications where we seem to need to be calculating with more constrained situations rather than whole worlds. Yet another alternative , though, is to associate the content of a declarative sentence with not merely a situation in which it is true, but a situation that *exactly* verifies it. This is the framework for semantics developed in Fine, and is very much the minority view.

Moltmann in her article is very clear about the reasons why she favours

this minority view, and I briefly summarize the two most fundamental ones here in the next subsection. To my own mind, for anyone interested in the problem of compositionality and linguistic meaning, these two problems that dog the first two approaches are deal breakers.

1.1 The Problem of Content

In the classical possible worlds approach to content, the object of John´s belief in (1-a) is indistinguishable from the object of his belief in (1-b) because the complement clauses, both being logically necessary given a particular mathematical language, are true in *exactly* the same worlds.

(1)   a.   John believes that 1 plus 1 is 2.
       b.   John believes that the square root of 9 is 3.

However, it seems intuitively clear that John could possibly believe one of those propositions without believing the other. The problem arises because identifying the content of a proposition with the set of worlds in which is it true is too *loose*, and generous and does not do justice to the narrow specifics of what each proposition is *about*. Exact verification is a way of getting at the specific content of a proposition without getting over specific and requiring identity of syntax or word choice (Moltmann discusses the structured propositions proposal of Cresswell 1985 as an example of this *overly* fine way of representing propositional content).

Of course, this problem has been well known in the philosophical literature for a long time, and has never been satisfactorily solved. Why then have we semanticists, as a field, been ignoring it? I think the reason for this is that descriptively speaking, there are very few instances of actual get-your-hands-dirty semantic analysis that require one to consider such cases. The view seems to be that a well chosen set of examples can upset the toolbox, but this is of interest only to philosophers (or semanticists with their philosophy hats on), it need not disturb the ordinary day to day business of writing semantic descriptions. This pragmatism, coupled with the belief that someone will eventually figure out a solution and the semantic descriptions in the old system will simply be translatable into the new one, seems to justify persisting with the possible semantics framework, especially since it seems to be able to do many things quite easily and elegantly.

But, I would argue, the failure of the toolbox on examples like (1) is fatal. The whole business of semantics as a field of endeavour must surely be to give us a theory of *why things mean what they do*, i.e. a theory *of* ' content'. We could imagine many computational systems that perform

pretty close to human judgements about content, and overlap with them in the vast majority of cases, but which are not in fact exact representations of the human semantic system. The failure of the possible worlds toolbox on (1) shows us that truth in a world, or even in a set of all possible worlds, is *not* equivalent to a human speaker's understanding of the content of a proposition, even though in many cases it looks like a good proxy for it.

So if we are interested in modeling 'the human speaker's understanding of the content of a proposition', then we have to build a more realistic system. (see also Pietroski 2005, Pietroski 2018).

In fact, it is simply not true that the possible worlds toolbox works beautifully and elegantly in all other cases— it is continually throwing up puzzles and paradoxes for natural language semantics which semanticists then solve in increasingly baroque ways (see Ramchand 2018, Ramchand 2019 on the imperfective paradox as a discussion of one such case).

The reason that Fine's truthmaker semantics is a better starting point for a theory of content, is that it employs 'exact verification', this means that for a situation that verifies a particular sentence, *all its parts are relevant*, and there is nothing extraneous: " In truthmaker semantics, logically equivalent sentences will have different semantic values whenever they are 'about' different things. Moltmann, pg 11"

This feature of Truthmaker semantics also enables a direct and intuitive account of the notion of *partial content* (Yablo 2015, Fine 2017b, Fine 2017c). The problems for the standard toolbox arise from the fact that possible world semantics is not *really* tracking content, but is just a very good proxy for it in many cases. Problems that the standard toolbox have with 'partial content' in multiclause utterances, as summarized in Moltmann's article, highlight a failure to meet a basic desideratum of compositionality— the bare and incontrovertible fact that human speakers of language systematically build more complex meanings from simpler units, in a way that is creative, open ended and reliable across users of the same code. If we cannot track how the partial meanings are contained in the larger ones they are built from, we are missing a basic intuition underlying compositionality.[1]

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[1]The classical toolbox can build functions of complicated types, and type shifting principles can be employed in principle at will to ensure function argument composition at every step. I would argue that the kind of compositionality that modern semantic theories achieve is mathematically trivial and not substantive at all (see also Higginbotham 2007). The power of such a system will always deliver on Frege's Conjecture in the sense of Heim and Kratzer (1998). The result is only satisfying and impressive, if certain psychologically plausible constraints are adhered to in addition. In particular, the semantic contributions of the 'pieces' should retain some integrity across the different constructions that they appear in, and the dependence of semantic complexity on symbolic hierarchical complexity

Of course, going the exact verification route requires rethinking many of the core ways of thinking about possibility and modal notions in general, which is why the programme is potentially disruptive and revolutionary. After all, the treatment of modality and the intensional complements of attitude verbs has been thought of as one of the success stories of modern semantic theory. Do we really want to throw the baby out with the bath water? As we will seen in section 2, Moltmann proposes a theory that is designed to preserve the advantages of the classical account while still taking advantage of the superior ontological set up of truthmaker semantics.

2   Moltmann's Proposal for Attitudinal Objects

As Moltmann points out: " Truthmaker semantics as developed by Fine assigns content only to sentences and has not been developed so as to allow for an application to attitude reports and modals in general."

The path of least resistance would have been to try to interpret the complement of an attitude predicate as a proposition, but in Fine-an terms, i.e. something whose content is defined by the pair of sets of situations which are its verifiers and falsifiers. However, Moltmann does not take this route for two reasons: firstly, because she is interested in preserving the connections between modals and attitude reports; and secondly, and because she thinks that simply making the proposition the internal object of an attitude predicate obscures the difference between the 'content of an attitude' and the 'object of an attitude'.

In fact, this latter point, or something similar to it, has also been made in the literature by Moulton (2009) and Kratzer (2006), albeit using a traditional possible worlds toolbox. Essentially, what Moulton too has been proposing is that *that*-clauses in particular are not themselves semantically the objects of the attitude, but predicates of propositional content which *modify* the object of the attitude. In Moulton (2015), he gives this idea plausibility by showing that *that*-clauses are actually free to combine with nouns directly, presumably by some form of predicate modification ((2-a)), even though in general it seems that nouns cannot take propositional complements if expressed as pro-forms (such as *so*), or as *of*-PPs ((2-b) and (2-c)).

(2)   a.   The belief that the world is round.

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should be maintained (see section 3 for an elaboration of these desiderata, and an argument that they are not met for traditional analyses of modal verbs in natural language).

b. *The belief so.

c. *The belief of that/of it/of the story.

In general, it seems correct that we want to distinguish between matrix verbs like those in (3) which take *that*-clauses that provide the 'content' for a particular attitude, and those in which the *that*-clause is the object of the communication verb, the actual thing communicated (4).

(3) a. Most baseball fans believed/knew/expected that the Giants would win.

b. Most baseball fans believed/knew/expected it.

(4) a. Albert boasted/commented/complained that the results were fantastic.

b. *Albert boasted/commented/complained it.

(data adapted from Moulton 2015).

I make the point about the Moulton and Kratzer approach here because I wish to emphasize that the innovation of taking a *that*-clause to be a predicate providing content to the real 'argument' of the attitude verb is not just available to those who subscribe to truthmaker semantics. Kratzer and Moulton implement their analyses in a standard possible worlds framework. Note however that the contribution of the *that*-clause is a predicate of propositional 'content' even for them. Since I have already argued that the possible worlds framework fails precisely in its inability to give a fine grained enough characterisation of propositional content, I will not go into the the details or consider that particular formal implementation further (although the general idea seems to be shared).

Turning to the Moltmann implementation of the intuition, she argues that "sentences embedded under attitude verbs act as predicates of attitudinal objects specifying their satisfaction conditions."
The formal representation looks therefore something like this, in the case of the attitude verb *claim*.

(5) a. John claimed that S.

b. $\exists e(\text{claim}(e, \text{John}) \ \& \ [\textit{that}\text{-S}](\text{att-obj}(e))]$
(assuming a unique attitudinal object att-obj(e) associated with a Davidsonian event argument e of an attitude verb)

Moltmann proposes instead a novel ontology of attitudinal and modal objects, extending Fine-an truthmaker semantics by expanding the ontological base and the kinds of truthmaking relations. She argues that these additions

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to the ontology are justified by the implicit patterns and categories found in natural language. Most concretely, attitudinal objects are the referents of the nominalizations of attitude predicates, but they are also the implicit objects of attitude predicates whose content is described by the embedded clause. Thus, attitudinal objects are the kinds of things that have a *certain kind of content*, the kind of content propositions can also have. However, attitudinal objects can be linguistically distinguished from both propositions and actions, and the nature of the satisfaction condition can vary, depending on their 'flavour' .

A summary of these drawn from the paper is given in (6) below. (A discussion and motivation of the selectional relationship between different types of attitudinal objects and different kinds of satisfaction predicate is given in Moltmann 2018).

(6)

Attitudinal Object	Satisfaction Predicate	Examples
Word-to-World Fit	*true, correct*	beliefs, claims judgements
Needs and obligations	*fulfill, satisfy* *follow, ignore*	requests, demands, promises
Permissions and possibilities	*accept, take up*	invitations and offers
Planning	*realize, execute*	intentions and decisions

There are a number of things worthy of note here. First of all, modal attitudinal objects do not come out as a natural class here, if we are classifying them by the type of satisfaction predicate they invoke, and they are interspersed with attitudinal objects corresponding to matrix predicates that do not show up as auxiliaries in the same way. In one sense, this unified treatment is a strength of the proposal (and of the corresponding possible worlds accounts, which Moltmann was at pains to retain) in that the parallelisms between the constructions with embedding under an attitude predicate and the function of a modal auxiliary are made more explicit, underpinned by the same kind of ontological object in the explication of the semantic building blocks. The parallelism is justified, among other things, by the phenomenon of modal concord, where the semantic force of embedding predicate can license a congruent redundant modal in the embedded clause (7).

(7)   a.   John insisted that Mary leave.
      b.   John insisted that Mary should leave.

There are also however many embedding predicates which do not seem to have an appropriate corresponding 'harmonic' modal auxiliary (in the terminology of Kratzer 2006). Thus, Moltmann and the classical accounts are in agreement here, the only source of disagreement (and this is great enough) is that Moltmann takes very seriously the problem of 'content' and wants a theory that does justice to the specificities of content in these and other constructions. She thus embraces a kind of theory which builds on forms of exact verification/satisfaction, and the richer set of ontological objects and relations that it allows in principle.

I fully agree with Moltmann that the central problem here is one of elucidating content, and that frameworks employing exact verification are the only ones which have a chance of doing justice to the natural language facts and implicit patterns. In section 3, I will argue however, against the consensus, that there is in fact something distinctive about modal auxiliation proper that deserves a separate treatment from attitude predicates. But before we get there, in the next subsection I want to highlight a different aspect of the issue of attitudinal objects which relates to the discussion of the difference between natural language ontology and cognitive ontology (cf. Moltmann 2020), and how these notions respectively relate to the syntax of natural languages.

2.1   On Nominal Polysemy and Content

Moltmann's analysis of CP complementation in natural language discussed in the previous subsection is part of a larger project on natural language ontology (Moltmann 2017, Moltmann 2020). She argues that natural language ontology is an important domain within 'descriptive metaphysics' (using the term from Strawson 1959) , which is distinct from the kind of foundational metaphysics that the philosophical tradition tends to engage itself in. This project analyses the ontological commitments implicit in natural language(s) itself, one of the most pervasive and important reflections of our human engagement with the world, and is a project to which Moltmann has contributed consistently in various contributions over the years (e.g. Moltmann 1997 on part whole structures,Moltmann 2009 on tropes as the particularized property denotations of adjectives, Moltmann 2013 on abstract objects). As Fine (2017a) argues, there is a case to be made that progress in foundational metaphysics *relies* on a close and nuanced understanding of the descriptive metaphysics involved in natural language ontologies. But even if that were not the case, as a linguist, it seems to me that the project of natural language ontology is crucial if we are to understand the compositional products

of meaning and meaning building in language and the mechanisms by which it is embedded in our cognition and cognitive processing more generally. The spare and elegant axiomatization of semantic descriptions anchored just in truth and reference to particulars simply does not do justice to content and partial and incremental contents that we see in language. Exploring natural language ontology in its own right, taking the internal evidence as primary is a prerequisite to getting this kind of deeper understanding. Having said that, exploring these specifically linguistic patterns also raises deep and difficult questions about the relationship between the ontologies required for language specifically and those that are part of a more general cognitive ontology. As a linguist, I am also interested in the question of how the syntactic representation of content relates to these ontological commitments, and in particular to the distinction between lexical and functional content when it comes to the syntax-semantics interface.

The important semantic distinction we have seen so far in the understanding of CP complementation, and the one which has motivated the existence of attitudinal objects in the ontology, is a distinction that we see also in the nominal domain.

Consider the sentences in (8) below. The noun 'book'. in English and in every other language I know can refer to the book *qua* object, or the book *qua* literary content. In (8-c) you can see that the 'same'-ness of the book can refer either to the identity of physical copy, or to the identity of literary content.

(8)   a.   John read the book.
          b.   John put the book on the table.
          c.   John read the same book as Mary.

This is not a polysemy unique to names of concrete objects. Even abstract nominals like 'the argument' (in the sense of a sequential representation of reasoning) have an equivalent vagueness.

(9)   a.   Mary understood that argument.
          b.   Mary read that argument.
          c.   Mary erased that argument from the blackboard.

The written manifestation of the argument can be erased, but only the logic behind the argument can be understood. The type of reading that the nominal gets is determined not just by context, but by the selectional pressures of the verb that the nominal is an argument of. Moreover, we know this is systematic *vagueness* because of the classic zeugma and ellipsis tests targeting

the different readings of the same NPs (10). Unsurprisingly, we do not know of languages which systematically mark the use of a noun as content-denoting vs. physical object-denoting with overt morphology.

(10) a. Mary read the argument through again, but didn't understand it.
      b. John has read the book that Mary just put on the shelf.

I think this ubiquitous phenomenon is instructive because it shows us that what is happening in the interpretation of sentential complements is neither uncommon, nor specific to CPs. Moreover, the properties of the alternation are eerily similar: the interpretation of a DP as either object referring or content referring is not signalled overtly, and it is closely tied to the selectional properties of the argument taking predicate. But imagine if we treated the DP case analogously to the CP one. In (11-a), the verb *put* takes the physical object denoted by *the book* as its argument. In (11-b), however, the object of understanding, could on this view be a special ontological object, let us label it a Thought/Idea for concreteness, a special kind of 'cognized object' (on analogy with attitudinal object) whose *content* is somehow associated with the physical object 'the book', because the content of those ideas inheres in the book in question. So in fact, the nominal 'the book'. is a predicate which describes the content of the thing understood, rather than being directly the object of the verb. The toy neo-Davidsonian representations are given below each sentence.

(11) a. Juliet put that book on the table.
          ∃e[putting(e) & Agent(e, 'Juliet') & Theme(e, 'the book') Result-Location(e, 'on the table')
      b. Juliet understood that book.
          ∃e[understanding(e) & Agent(e, 'Juliet') & [DP](Cognized-Obj(e))]

Following the Moltmann line of attack, these are exactly the semantic representations we should be trafficking in the nominal case as well. Now, maybe (11-b) is actually the right way to go for sentences of this type with special cognition verbs, but there would be more resistance in the linguistic community to positing these kinds of representations here than in the CP domain, and it is worth asking why. The problem is that we as linguistic semanticists often think about rich conceptual contents for DPs and polysemy as part of the connection to truth conditions that we do *not* reify as part of the semantic representation per se. Conceptual content of roots is part of a domain of meaning that, if it has structure and connections to other cognitive domains,

this is part of a black box that the syn/sem representation itself does not engage in. Under this view, the different meanings of 'book' in terms of its different contributions to the truth conditions, involve polysemy and the denotation of a DP with the lexical content given is simply vague with respect to a systematically available network of possible meanings. In other words, do we need to invoke an attitudinal object in the representation when we can explicate its effects in the particular choice of precisification of meaning for the DP itself?

There is some reason to be dissatisfied with this kind of 'black box'-ism, because I think that formal semantics has not really provided satisfying mechanisms for dealing with the phenomenon of polysemy as distinct from pure homonymy for completely distinct meanings (ambiguity), and that what we are seeing here is a kind of *systematic* polysemy that cuts across category differences, languages, and constructions.

Nevertheless, the ubiquity of the phenomenon of slippage between contents vs. denotata that 'have' those contents suggests a cognitive generality to the distinction. Once again, I do not know of any language that does not do this effortlessly, and without piling on morphological help to signal it. And while it appears that CP complementation involves a number of syntactic and semantic properties that distinguish it from DP complementation, DP complementation itself is the 'normal' and yet seems to rest on the same sort of implicit ontology. So if language *never* makes this implicit difference in type of meaning explicit, is the distinction really something that is built by the linguistic system at all, or is it rather part of a more general and pervasive cognitive ontology?

There are a host of interesting questions that arise here in the nominal domain around how lexical contents systematically yield a predictable network of metonymically related denotata in cases like (10), even possibly extending to denoting events canonically *associated* with those denotata (e.g. *Rachel began the book*). Which aspects of these predictable networks are 'seen' by the functional structure of the syn/sem systems of natural language, and which aspects of them reside in more general systems of cognitive uptake?

I don't know what the answer is here, but I do think that Moltmann in her work has uncovered something deep about the semantics of these items, and that the intuition shared by both Moltmann and the Moulton/Kratzer line of research in emphasizing the difference between propositions and their content is important. I am still unpersuaded about whether these facts really do motivate the existence of this range of different attitudinal objects in the *linguistic ontology*, as opposed to telling us something deep about cognitive ontology. I am, however, persuaded that there is a binary distinction between

interpreting the embedded CP as a the direct propositional theme argument of a verb of communication, and as something that denotes rather the *content* of the attitude in question.

This brings us back to the notion of content, and the urgent task of any formal semantic theory should be to have a fine enough grained theory of content that it will be able to do justice to the meaning of embedded complements of attitude predicates in the first place. Taking the project of exploring of natural language ontology seriously is the first step towards doing that, and creating a theory that can inform both mentalistic and foundational metaphysical projects.

3 Content Monotonicity and the Semantics of Modals

In this final section, I would like to return to a different notion of partial content because I think there is a sense in which sentences with modal auxiliaries are different from those that contain true clausal recursion (embedding), and there is an important fact about their interpretation and its connection to size of syntactic structure that shows the relevance of partiality beyond the obvious cases of multiclause utterances. Moreover, a modal sentence like (12-a) is monoclausal, while (12-b) is biclausal. This is an important difference in syntactic representation which I feel is in danger of getting lost if we unify too completely over the two cases, even if intuitively the modal force seems similar, if not identical.

(12)   a.   Elizabeth demanded that Lucy practise for 2 hours every day.
        b.   Lucy must practise for 2 hours every day.

3.1   Modal Auxiliaries and the Classical Toolbox

Let us first consider the formal semantics of sentences like (12-b), the canonical modal auxiliary sentence type. Kratzer's early work on the semantics of modals was essentially a semantic account with plenty of room for contextual and discourse factors (Kratzer 1977, Kratzer 1991). The idea in brief was that the semantics of a modalized sentence could be analysed with just three factors within a framework of possible worlds semantics: (i) the quantificational force of the modal in question (ii) the modal base that the modal quantifies over and (iii) the ordering source which imposes a contextual ordering of worlds within the modal base. While the first factor was contributed by the modal itself, the second two came from presuppositional properties of the modal combined with contextual and discourse factors of use. However,

it is well known from typological descriptive work and from syntactic cartography that there is a powerful and apparently exceptionless generalization which states that *epistemic readings reside higher in the clausal hierarchy, at the same height or possibly outside tense, while circumstantial and dynamic modals are found inside tense.* Further, dynamic modality is hierarchically lower than circumstantial modality (Nauze 2008, Cinque 1999).
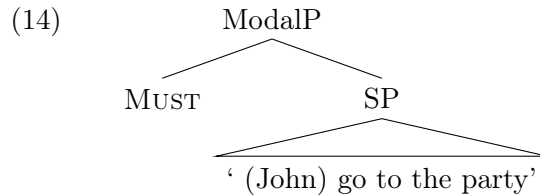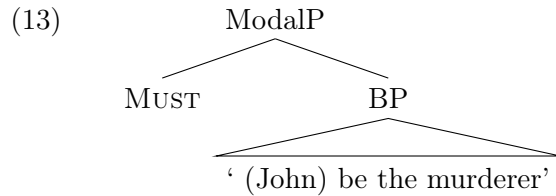
Recognising that the standard account had no obvious way of accounting for these robust crosslinguistic generalizations, Hacquard (2006) (in her dissertation and in subsequent work) made an important and influential proposal extending the Kratzerian system to account for these patterns. She proposes a system that ties particular types of interpretation to height in the structure. Her idea is to replace the base world from which the modal base is calculated within a standard possible worlds semantics for modals, with an event instead, and relate the semantic differences to differences in how that event is anchored/bound. When the modal is speaker-oriented, it is keyed to the speech time and receives an epistemic interpretation; when the modal is subject-oriented, it is keyed to the time provided by tense and receives a root interpretation.

Hacquard (2006) keeps otherwise intact the central structure of the Kratzerian solution: modals are functions from sets of possible worlds to sets of possible worlds; a restriction via contextually defined modal bases, ordering sources, existential vs. universal quantification. However, while this is an important step forward, it comes up against a rather deep problem due to the very nature of the theoretical framework and its assumptions. Basically, since modals are functions from sets of possible worlds to sets of possible worlds, they need something of the propositional type to combine with. In order to reconcile the syntactic position of the circumstantial modal (i.e. below tense and aspect) with the need for it to combine with the propositional type, Hacquard's new theory is forced to base generate aspect as an argument of the verb and then move it for type reasons, leaving something of the propositional type. This is technically possible of course, but if we are allowed to do such things why is it that we get the ordering we do in the first place? The ordering Asp > Circumstantial Modal is necessary in this style of implementation if the event relativity of meaning is to be captured by the mechanism of binding, but this is actually at odds with the phrase structure ordering usually found across languages. So syntactic hierarchy requirements are pulling in two different directions here. But since the phrase structure base ordering has robust confirmation in typological facts, it must be the decision to implement the required semantic differences via event *binding* that is the culprit.

A further indication that Hacquard's solution simply does not do the job is that the system loosens up only just enough to relativize the base event/world to syntactic height, and still leaves unexplained the correlation of height to type of *modal base*. For example, it is still possible in Hacquard's system for 'high' modals take the speech event as the base event, while still choosing a circumstantial modal base. In fact the correlations are exceptionless: the base world is the speech event if and only if the modal base is epistemic; the base world is the VP event if and only if the modal base is circumstantial. Hacquard notices this of course, and offers a stipulation to handle one direction of the correlation, but admits to having no explanation of the other. To date there has been no proposal offered in the literature to fix the Kratzerian system so that it actually delivers the generalizations found in natural language with respect to height of modal and modal base.

3.2 Modal Height and Syntactic Size of Prejacent

The obvious desideratum is the following situation, a modal such as *must* in English, which is ambiguous between a circumstantial (deontic) interpretation and an epistemic one has one basic denotation, let us call it MUST just to have a mnemonic label. We want to be able to say that MUST can be merged at different heights in the syntactic representation to adjoin to either the phrase B(ig)P or the phrase S(mall)P, where the functional structure expressed by the verbal extended projection SP is properly contained in the functional structure expressed in BP.

(13)

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          ModalP
          /    \
      MUST      BP
               /  \
        ' (John) be the murderer'
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(14)

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          ModalP
          /    \
      MUST      SP
               /  \
        ' (John) go to the party'
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Further, we want the compositional semantics to be sensitive to the nature of what MUST is merging with, such that the two different interpretations arise from the *different* denotations of BP and SP respectively.

I note here that even though modals in English uniformly seem to end up in the highest inflectional node of the tree (in a position where they can happily host negation and invert with a Subject in questions), the typological evidence of stacked modals uniformly suggests a height difference in terms of first merged position. Moreover, there is distributional evidence that epistemic and deontic readings of a modal like MUST really do combine with different natural classes of prejacent. As noted in Ramchand (2014), while prejacents like progressive, perfect and stative *be* allow epistemic readings with *must* (15), epistemic readings are systematically disallowed with episodic readings of main verbs, and dynamic passives (16). [2]

(15) a. John must be doing the laundry.
      b. John must have left the house.
      c. John must be in the office.
      d. John must own a lot of books.

(16) a. *John must go to the party.   (only deontic)
      b. *John must be arrested for that crime.   (only deontic)

The facts concerning the syntax semantics interface are telling us something very specific here about the relationship between hierarchical structure of the extended verbal projection and semantic interpretation: prejacents in combination with circumstantial readings contain less structure than prejacents in combination with epistemic readings.

The most minimal way this could be the case is literally that MUST takes B(ig)P as its semantic complement in one case and takes S(mall)P as its semantic complement in the other case, where we want to be able to see the content of the SP as *part* of the content of the BP. Note this is *not* what the standard toolbox allows you to do because *anything* that a modal combines with has to be of the propositional type. We put a further natural and desirable constraint on the meaning building here and say that we want the meaning of the whole modalized clause also to have the meanings of SP or BP as a *part* of it.
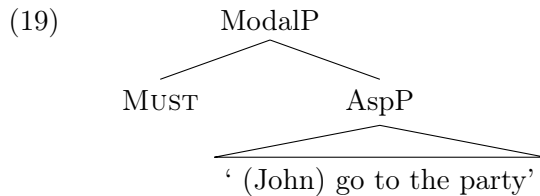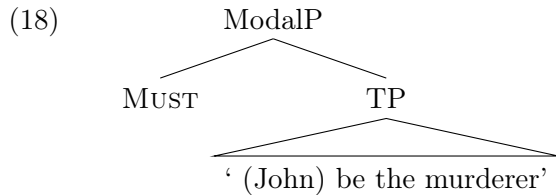
(17) a. MUST ([[BP]]) = situation expressing epistemic modal state.
      b. MUST ([[SP]]) = situation expressing deontic modal state.

So the puzzle now becomes, what kind of meaning must MUST have and what must the denotations of BP and SP be to satisfy this desideratum.

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[2]Ramchand (2014, 2018) argues that the generalization is stativity (either basic or derived), and that epistemic *must* can only combine with prejacents that can felicitously occur with the present tense in English.

Under truthmaker semantics with exact verification by situations, we have a fighting chance of setting up a semantics that directly tracks the ontological units that language makes use of to build up to propositions of different types. Intuitively, we want the set of situations that verify (and falsify) (17-a) above to be in a certain natural relationship to the set of situations which are the verifiers (and falsifiers) of BP. Moreover, we want the set of situations that verify (and falsify) the situation denoted by SP *not* to be the same as for BP, but to also bear a systematic relationship to it, to be *part* of it in some way.

The solution proposed in Ramchand (2018) starts off by noting that BP is some unit at least the size of TP, while SP is only an AspP.

(18)

ModalP
├── MUST
└── TP
    └── ' (John) be the murderer'

(19)

ModalP
├── MUST
└── AspP
    └── ' (John) go to the party'

The claim is further that this *does* make a difference to the denotation in a way that matters for the semantics of the modal. I reiterate, this is *never* the case with the standard toolbox because modals have to combine with propositions, whose denotations are particular mappings from possible worlds to truth values, regardless of their 'flavour'.

3.3 Using Situations and Exact Verification to Understand Content

The set up in truthmaker semantics (Fine 2012, Fine 2014, Fine 2017b, Fine 2017c) is fundamentally different with regard to content, because "Exact truthmaking holds between a situation and a sentence just in case the situation is wholly relevant for the truth of the sentence". (Moltmann, this volume). Let us remind ourselves of the basic features of the theory that Fine proposes:
(i) Declarative sentences are made true by situations that are their exact

truthmakers.

(ii) Situations are mereological parts of worlds and the standard conditions on conjunction, disjunction, existential quantification hold, together with a standard mereological notion of fusion.

(iii) Truthmaker semantics assigns to each sentence not just its set of verifiers, but also its set of exact falsifiers (or violators) which is used in defining negation.

(iv) The domain of situations includes impossible situations in addition to actual and possible ones.

Although Fine does not discuss the application of the theory to sentence internal composition, the strength of the exact verification approach is that in principle it makes it possible for us to track the precisification of content within the clause from the lowest lexical elements through to the various functional projections and adjuncts that create the description of the situation finally constructed. Consider the clause in (20) below, bracketed according to syntactic constituency, with standard labeling. The core situational description built involves the lexical verb and its internal and external arguments (which I am here calling the vP) and is the 'smallest' coherent situational description built up by the sentence. I am further assuming that the PP 'for his root canal' is adjoined to the thematic domain of the clause, and that 'reluctantly' is adjoined to the inflectional domain, and that 'yesterday' is adjoined after the addition of tense anchoring information (here, past).

(20) $[_{TP2}$ Yesterday, $[_{TP1}$ Hector PAST $[_{AspP}$ reluctantly$[_{vP2}$ $[_{vP1}$ ~~Hector~~ visit the dentist] for his root canal]]]]

The interesting thing here is that 'Hector visit the dentist' does in fact already describe a situation, albeit a rather open ended and underspecified one. *All* declarative sentences underspecify some aspects of the situations they describe, so this it not qualitatively different from what we expect from situations in the first place. Let us call the sub-sentence expressed by the inner vP1 S1, and allow that it already stands potentially in a truth making relation to the world— in other words, its denotation will be the pair which consists of sets of its situational verifiers pos(S1) and falsifiers neg(S1).

(21)   a.   S1 = $[_{vP1}$ Hector visit the dentist]

       b.   [[S1]] = $< $ pos(S1), neg(S1) $ >$

Because S1 expresses descriptive conditions for a situation without providing any tense information, there is a question about whether it can have any exact verifiers on the world side at all. This is because temporal information about the situation will always be in some sense extraneous, and one might argue that any such situation would not be 'wholly' relevant to the description in question. However, this I think would be not be the correct conclusion. We already have to tolerate some underspecification in the sense that a simple sentence like *Hector visited the dentist* would indeed be 'verified' by a situation in which Hector visited the dentist last week, but also by situations where Hector visited the dentist a year ago. Further, it cannot be that we disallow situations on the side of the world from having detail not mentioned in the sentence, such as what Hector might be wearing, for example. So if Hector is wearing a yellow hat in that dentist visit, the situation in which he does so is still considered an exact verifier for the sentence, as are situations in which he wears a red hat, or a dress, or is whistling a tune, etc. etc. So some degree of 'detail gap' is acceptable in exact verification, provided that the details in question are *detail regarding the already presupposed necessary features for the situation to be instantiated in the world* (situations exist in time and space, bodies have clothing, minds bear attitudes).

I would argue that existing in space and time are part of those necessary features for situations, and that the underspecification of the vP situation in (21) above is no different in kind from the fact that we do not mention whether Hector is wearing a hat or not. Therefore, in (21-b), we have a set of positive verifiers that includes situations from all over the temporal map. Now let us take a look at the slightly larger vP, where the PP has been added to the syntactic representation. We call this sub-sentence S2.

(22)　　a.　S2 = [$_{vP2}$ [$_{vP1}$ ~~Hector~~ visit the dentist] for his root canal]
　　　　b.　[[S2]] = < pos(S2), neg(S2) >

Here, we still are not specific about the temporal instantiation, but the syntactic representation contains a PP which precisifies that Hector's visit to the dentist was specifically for getting a root canal done. This means that the exact verifiers must not contradict this information, and the falsfiers will include all the events (of whatever temporal anchoring) in which he visits the dentist on a social visit, or just to clean his teeth. Since we have *added* information in going from S1 to S2, the exact verifiers for S2 will be a *subset* of the set of verifiers for S1. We can continue the process of adding information, and the AspP adds the information that Hector must be reluctant, and merging in the T node will add the information that the

verifying situations must be located in the past with respect to the speech time. Finally, with the addition of the adverb *yesterday* we narrow down the verifying situations to precisely those that happened yesterday.

The natural conjecture when looking at the hierarchical representation built by a particular language's syntax, is that information increases monotonically as structure builds. We might even propose a generalization or constraint on the syntax-semantics mapping for compositional meaning, which one might call 'The Monotonicity of Content', expressed informally below in (23).

(23)   *The Monotonicity of Content*:
        Given two monoclausal syntactic representations C1 and C2, both of whose verifiers lie in the domain of situations, if constituent C1 is an extended projection of C2, then the situational verifiers of C1 are a subset of the situational verifiers of C2.

There are two points to be clarified here: firstly, that something like monotonicity of content can probably be expressed in systems that employ loose verification as well, and secondly, that the actual *order* of the elements that successively precisify situational descriptions does not fall out of just this notion. But all of this is moot, if Monotonicity of Content does not actually hold in the first place. There are obvious problems that immediately arise when it comes to the folding in of speaker oriented adverbial elements (like *allegedly*), or indeed modal auxiliaries, as we will discuss in the next subsection. The point I would like to make here is that while it is natural to define monotonicity of content over subset relations among verifying situations, it is also possible to extend the notion in constrained ways to include certain other kinds of relations that allow complex meaning building. The phenomenon of embedded clauses shows us that the content of one proposition can *part* of another (however we choose to implement this), and the bridging relationships that allow this come from the restricted class of verbs taking propositional 'complements'. However, language is much pickier when it comes to the kind of content monotonicity it requires while still allowing a *single monoclausal* representation. In general, I think the problem of sentence internal partial contents is important enough that we should start with the (probably too) strict statement above and see how far it will take us. Note that the statement above careful to claim subset-ism only in the case of extended projections. In addition, it may be that speaker oriented and non at-issue modifiers will have to be syntactically integrated in different ways from the regular spine (as in Potts) in order to keep to the strictest

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interpretation of such a principle. It is a much more restricted version of compositionality than the one allowed by function-argument composition, if higher order types are admitted, but one that is more intuitively tied to a notion of content.

3.4   The Ontology Underpinning Modal 'Flavour'

How does this help us to solve the problem of modal height correlating with flavour of modality? Don't modals immediately cause a problem for such a draconian principle of Content Monotonicity in the first place (at least if it is thought of in terms of subsets and supersets of verifiers)? Space prevents a completely detailed and formal exposition of the solution, but I just sketch here how the challenge of modal sensitivity to height might be addressed using situational verifiers in a way that just doesn't seem possible with the traditional possible worlds toolbox. This in turn will lead us to propose a constrained and motivated addition to the allowed ways in which content monotonicity can be satisfied.

In Ramchand (2018), I argue that the modal auxiliary introduces a new situation (the base situation, or perspectival situation in the sense of Condoravdi 2002), and that a modal denotes a predicate that asserts that there is a CHOICE of some kind, against the background of a set of live alternatives or potentials. Under this view, the set of alternatives will be determined by the denotation of the prejacent. Or we could, on analogy with the interpretations advanced for embedded attitudes, say that the modal introduces a special kind of modal object, the 'live-alternative set' which is described by the prejacent in some systematic way.

(24)   a.   [$_{S1}$ Hector must [$_{S2}$ ~~Hector~~ visit the dentist for his root canal]]
        b. $\exists e(\text{CHOICE}(e, \text{Hector})$ & [S2](LIVE-ALTERNATIVE-SET$(e))$]

Since the prejacent is a constituent that has a set of situational verifiers, and since those verifiers in the case of 'small' prejacents consist of situations with many different time traces, we can say that S2 helps describe the live alternative set by intersecting the verifiers of S2 with the set of undecided situations. Then what the modal asserts is a CHOICE situation S0 involving 'Hector' in this case[3], where the alternatives are suitably constrained by the

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[3]Circumstantial modality often involves the external argument of the prejacent situation as the CHOICE pivot, but this is not strictly necessary, although the external argument of the prejacent sub-situation always ends up at the subject of the whole sentence. Sometimes an implicit agent can be the CHOICE pivot for the modal situation, as in 'Dogs must

prejacent. In Ramchand (2018). I argue that so called 'universal' modals are those in which the choice is exclusive (the *only* choice), whereas existential modals are those in which the choice is possibly one of many.

The CHOICE situation is then verified by situations held by Hector at the perspective time, in which Hector's *only* viable choice is contained in the set of Live-Alternatives, given some set of background constraints on admissable situations for Hector. (Note that we are not removing the dependence of circumstantial modal interpretation on pragmatic and contextual grounds which provide a shrinking of the domain of situations, we are developing a system where a systematic contribution to the meaning is given by the denotation of the prejacent.)

The reason this works when scaled up to larger prejacents is that the larger prejacent has acquired more content, and by hypothesis, is time anchored, and therefore the set of verifiers of S2 in (25) does not include any situations that are not anchored to the present tense (the same time as the perspectival situation introduced by the modal). The external argument of the CHOICE predicate here is also not a participant in the prejacent situation (whose participant list has been existentially closed by the time the CHOICE predicate is merged), but the SPEAKER.

(25)   a. $[_{S1}$ must$_{pres}$ $[_{S2}$ Hector be$_{pres}$ at the dentist.]]
          b. $\exists e($CHOICE$(e,$ Speaker$)$ & $[S2]($LIVE-ALTERNATIVE-SET$(e))]$

The CHOICE pivot is the speaker herself, and the Live-Alternatives are the assertoric alternatives open to her. Once again, this alternative set of assertions is 'described' by the denotation of S2 which acts as a predicate constraining those assertoric alternatives. The meaning of MUST can remain the same: the speaker is in a CHOICE situation (i.e. is operating against a background of assertoric uncertainty) where the speaker's *only* viable choice is contained in that particular Live-Alternative set. The Live-Alternatives here are the different propositions that the speaker could utter, her epistemic alternatives based on all direct and indirect evidence, intersected with the verifiers of S2.

The following table schematically lays out how the CHOICE predicate generalizes across size domains in a way that is sensitive to (i) the content built up by that point and (ii) the argument available as CHOICE pivot. (I include dynamic modality here for completeness although there is no space here to discuss this case in detail).

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be carried.'

Type	Modal Prejacent	Choice Pivot	Source of Uncertainty
Dynamic	atemporal situations	Actor	Causal abilities of Actor
Deontic	unanchored temporal situations	Sit. participant	Undecidedness of Future
Epistemic	anchored temporal situation	Speaker	Incomplete Knowledge

The above is therefore a sketch of a solution to the understanding the dependency of modal interpretation on the size of the syntactic representation of the prejacent. It is only possible with a theory that tracks content in an exact way. Even though Monotonicity of Content can be expressed using loose verification as well, what we lose is the specificity of content. Once we say that the denotation of a chunk of structure corresponds to a mapping from possible worlds to truth values, we are describing the output truth conditions in a way that makes the detailed content opaque and unrecoverable. I do not see a way to use that meaning to provide content to the live alternatives that are built when that very same structure then combines with a modal.

3.5   Return to Attitude Reports

Working out the semantics of modals while paying attention to the monotonicity of content has revealed a role for the notion of CHOICE as a pervasive, perhaps universal cognitive category, and one which human appraisers want to label, track, and take notice of. For me, the importance of the truthmaker semantics lies in its ability to track content in a more fine grained way, although taking a leaf out of Moltmann's book, one might want to make a case for 'choice' as a special kind of ontological eventuality, distinct from other situations or actions. It is not merely something like 'thinking' or 'believing' which come with their own lexical items and can be used without any other verbal support, the CHOICE notion is parasitic on, and sits on top of the normal situational description. It also, importantly, can be added to 'normal' situational descriptions without introducing a whole new clause (even though there is good evidence that there are two, albeit related, situations being expressed). This makes it different from the situation of attitude predicates, which by definition embed a whole clause as their complement with its own independent verbal extended projection. For this reason, the nexus of a situation of CHOICE and its ALTERNATIVES seems to be a way in which Content Monotonicity can be satisfied, in addition to subset relations. At least the evidence from monoclausal utterances crosslinguistically shows us that it is a privileged kind of situation to situation relationship. As we have seen from Moltmann's own work, the range of attitude predicates is very rich and the range of attitudinal objects as new elements of the ontology is,

although smaller, also quite rich. Given that these predicates introduce an attitude *whose content can be that of a proposition*, it stands to reason that modal notions could also show up with full embedding. This, I submit, is the reason that one can find matrix attitude predicates that seem to mirror or rather share the content of a modal auxiliary. But the interesting and telling fact is that the other direction does not hold—— modal notions make good auxiliary verbs while not every notion that can be expressed as an attitude predicate makes a good auxiliary. This means that a verb selecting for something whose content can be described by a propositional predicate is an important generalization in its own right and isolates a certain class of predicates, but it is not enough to guarantee that that 'verb' can be integrated with a propositional predicate in the context of a *single* extended projection, a monoclausal construction. It seems to me that this more restricted subset of verbs that combine with situational descriptions is an additional and intriguing pattern that tells us something about monotonicity and unity of situational contents. So the fact that modals can be auxiliaries as well showing harmony with some propositional attitude predicates is predictable because of the common denominator of selecting for propositional contents, but the phenomenon of modal *auxiliation* specifically needs to also be distinguished and the reasons for its specialness better understood. I have suggested that this specialness arises from the way in which the notion of CHOICE and undecidedness is built into the semantics of natural language statements as a natural extension of how to describe the world.

4   Conclusion

I have tried in my commentary to emphasize why I think that truthmaker semantics and the intellectual programme that it invites it the most promising way forward for formalizing natural language semantics. It is the only framework which to my mind offers a suitably fine grained notion of content, and has a chance of making progress on many of the generalizations about the syntax-semantics interface that are keyed to hierarchic representation and the compositional building up of content. Absent a formal system that represents a fine grained enough notion of content, we cannot begin to discuss how content grows *within* the sentence in a systematic way.

Moltmann's work is squarely within the agenda of truthmaker semantics and has many of the same reasons for pursuing analyses in these terms as I have. I have tried to summarize her position on attitude predicates and engage with the content of the main ideas she puts forward, which

are in my opinion always insightful and expressed clearly and explicitly. The promise inherent in truthmaker semantics is considerable, but progress will only be made if more scholars engage in the enterprise of exploring the possibilities that it opens up. Instead of adding baroque extensions to the classical model, we should be willing to entertain the possibility of new and different ontologies, if we are to do justice to the central notion of content in the understanding of natural language sentences. Moltmann's excellent paper is a part of the programme that keeps hope for progress in this area alive.

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